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ABSTRACT

This study investigated Australian preservice teachers' use of computers during teaching practice. Participants were 46 graduates entering a preservice elementary teacher education course at an Australian university in 1999. Data were collected using the Personal Computer Efficacy Questionnaire at the beginning of the course. The School Computer Access Survey (which also solicited information on demographics and types of computer equipment and programs used) was administered twice during the year following a practice teaching in schools. Data analysis indicated that respondents had a high level of belief in their ability to perform basic computing tasks. The results also highlighted the lack of technology use within Australian elementary schools and found that classroom teachers who did not use computers themselves did not encourage student teachers to use them as part of the teaching-learning process. Though computer use by student teachers rose over time, there was still a low level of computer use overall, with one in four student teachers not using computers in the classroom. (Contains 14 references.) (SM)

Use of computers by teacher education students during teaching practice.

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Introduction

> *... most student teachers ... neither routinely use technology during field experience nor work under master teachers and supervisors who can advise them on the use of information technology.* (CEO StaR Report)

Pre-service teacher education courses tend to focus on the content of school curricula and the cognitive development of pre-adolescents and adolescents. Teacher education students at the commencement of the 21st century are also expected to develop the skills, techniques, and knowledge necessary to apply various learning technologies in school classrooms. Although there has been more than two decades of computer use in schools and universities, educators do not fully understand the links that develop between learners, their teacher, and whatever learning technologies they use.

In this paper a range of issues arising from the inclusion of mandatory computer-related subjects in a pre-service teacher education course are explored. Of particular importance are the feelings, beliefs and perceptions of student teachers about their ability to perform a range of computing tasks. In addition, links between such perceptions and the use of computers during a teaching practicum are investigated.

Over the past decade schools in Australia, the U.S. and other developed countries have been acquiring an increasing number of computers for student use. At the same time the nature and style of educational software has changed dramatically. The text-based drill and practice programs that characterised the first wave of educational software have been replaced with investigative or exploratory programs that often make extensive use of spectacular multimedia. Either in conjunction with those changes to school use and software, or as a consequence of the changes, teacher education programs in the area of educational computing have also undergone major modifications.

Related research

Pre-service teacher education

Studies of pre-service teacher education students and of beginning teachers have shown a reluctance to use computers in their teaching. Some researchers, for example Dunn and Ridgway (1994) in the U.K., believe that issues such as low numbers of computers, poor or inappropriate software, and timetabling constraints are factors that limit opportunities for all teachers, but especially for pre-service and beginning teachers. The quotation used at the start of this paper is part of a report on the situation in the U.S., but a similar situation exists in Australia and other countries.

Although not the focus of this paper, there are many reports noting that the majority of teachers currently employed in schools do not believe they are able to make effective use of technology in everyday classroom teaching. Only 20% of U.S. teachers are reported to feel they are adequately prepared to use computers in the classroom (CEO StaR Report). Becker, Ravitz & Wong (1999) report that some 70% of U.S. teachers are "reluctant" or "late adopters" of learning technologies. There can be no doubt that the lack of leadership and example by experienced classroom teachers is having a detrimental effect on use of computers by beginning and student teachers.

Wild (1996) has argued that there is a body of research evidence and anecdotal documentation available to show that computer-based learning technologies are greatly under-used for classroom teaching by pre-service teachers. The research indicates that this is a general issue in pre-service teaching courses, and occurs in a range of countries and within a variety of education systems. When the first reports of this phenomenon appeared more than a decade ago, not all schools and universities had significant numbers of computers available for teaching and learning. However today in the U. S. (Office of Technology Assessment, 1995), Australia (Shears, 1995), and many other countries, schools and university faculties of education provide a much higher level of computer access for students and staff. Despite this improved access to a range of computer related educational technologies, there is still evidence that these technologies are not being used for classroom based teaching and learning (Dunn & Ridgway, 1994).

Self-efficacy

Self-efficacy theory originally arose out of social learning theory and was initially applied in health related areas, but educational theorists have adapted the theory and model. Self-efficacy examines people's perceptions of their competence in a nominated area. The theory of self-efficacy was developed and linked with educational theory by Bandura (1986) in the 1970s. Since then Bandura and other researchers have clarified the concept of self-efficacy and expanded its use into many domains of educational research. An extensive body of research has been built up that reports on, and analyses, self-efficacy in many aspects of education at levels ranging from elementary school through to adult.

Self-efficacy has been defined as a construct relating to a person's self-perceived belief in their ability to carry out actions that will achieve designated goals (Bandura 1986; Pintrich & Schunk 1996). Self-efficacy differs from constructs such as task-specific self-concept and self-perceptions of competence because it is specific and it applies to particular goals. It is based on beliefs about what a person can accomplish with the skills and knowledge they already possess. It is not about acquiring new skills or increasing knowledge.

In his study of pre-service teachers Kellenberger (1996) reports that belief about success or otherwise with computers in the past has some influence on perceived computer self-efficacy. However the results of his study suggest that past achievement might not influence self-efficacy as much as the level of value a student teacher places on

computers in an educational context. Other research has found strong links between self-efficacy and later competence or achievement (Pintrich & Schunk 1996; Bandura 1986).

When applied to teachers using computers for educational purposes, self-efficacy would appear to be an important indicator of whether an individual will teach with computers at a later stage. Ropp (1999) uses the term "computer self-efficacy" and she notes there is research that shows while many teachers have positive attitudes to the use of educational technologies, they do not necessarily believe in their own ability to use technology in a classroom with students. One aim of the study reported in this paper was to ascertain the level of computer self-efficacy of a cohort of pre-service teachers, and to use this data to inform decisions relating to content and instructional mode in a compulsory learning technology subject.

Computer anxiety

Ever since people began to use computers in business and education there have been reports of users experiencing computer anxiety. Computer anxiety is just one of many different forms of phobia or anxiety that are reported in educational and psychological journals of research. In school education computers have been in use for only a relatively small amount of time, a little over two decades. However in this brief time the literature has grown to include hundreds of studies into school based computer anxiety.

Anxiety is an emotional state, and links have been established between anxiety and motivation, perception of content relevance, performance, and self-esteem. Dyck, Gee & Smither (1998) report on computer anxiety scales and other research dating from the early 1980s. However there is no consensus about what computer anxiety is and how it can be measured. Rosen & Maguire (1990) conducted a meta-analysis on quantitative research studies into computerphobia and noted that there were 66 different measuring instruments contained in the 81 studies analysed.

Method

Participants

In 1999 the cohort of 46 graduates entering a pre-service elementary teacher education course at an Australian university participated in this study. The minimum academic qualification for entry into the course was an appropriate undergraduate degree, and several participants had also completed an honors year or masters degree. Six (13%) of the participants were male. Eighteen (39%) participants gave their age as being under 25 years at the commencement of the course.

Data collection

This study reports on data collected by two instruments. The first, a Personal Computer Efficacy Questionnaire (PCEQ), was derived from the Computer Self-Efficacy Scale (CSE) developed and validated by Murphy, Coover & Owen (1989). Minor modifications were made to two of the three factors of the CSE to allow for local context. The developers report that these two factors accounted for 86% of the systematic

covariance among the CSE items, with alpha reliabilities of 0.97 and 0.96. The third factor, which explained only 6% of covariation, related to mainframe computing skills and was considered not relevant to this study.

The PCEQ was designed to ascertain the self-perceptions of teacher education students about their ability to use computers. There are 34 items in the questionnaire, all commencing with the stem, "I feel confident ...". Sixteen of the items are categorised as relating to basic computing skills such as "entering and saving data into a file". Twelve items, including "using a computer to organise information" and "understanding terms relating to computer hardware", are categorised as being concerned with advanced computing skills. The remaining six items in this questionnaire relate to skills associated with using the Internet and multimedia software. This questionnaire was administered during the first week of classes.

PCEQ items were scored on a 5 point Likert scale from strongly disagree to strongly agree. Because of the common positive stem all items were positive and none had to be reversed for scoring purposes. "Strongly disagree" responses were scored as 1, "disagree" as 2, and so on up to "strongly agree" which was scored as 5. SPSS version 8.0 for Windows was used to perform basic descriptive statistical analyses.

The second instrument, the School Computer Access Survey (SCAS), sought information about computer access and use for teachers, school students and teacher education students. It was administered twice during the year when participants returned to university from a teaching practicum in schools, in May and then in November. Most of the results and discussion are based on data collected in May 1999 following the first teaching practice for the teacher education students.

The SCAS included demographic questions about the type of school (government or independent), level taught (from K to grade 6), and whether the school was situated in an urban or rural area. The next set of items asked about the positioning of computer resources in classrooms, computer laboratories, and staff work areas. Respondents were also asked to indicate whether they and their supervisor used 'tool' software (word processors and spreadsheets), e-mail, or a WWW browser in non-teaching situations. The final item asked the student teachers to indicate whether they believed they were ready to use computers as part of the teaching-learning process in a classroom.

The major part of the SCAS related to the amount of use of the computers available in the school over the teaching practicum. Data were collected on how often supervising teachers, specialist teachers, and student teachers used computers with students.

Results and discussion

The Personal Computer Efficacy Questionnaire (PCEQ)

This questionnaire contained 34 items that for analysis were subdivided into basic computing skills (16 items), advanced computing skills (12 items), and course related

software skills (6 items). Among the basic computer skills, four items had a mean greater than 4.00 (in the possible range of 1 to 5) and 2.73 was the lowest mean.

Table 1 Means and standard deviations of high scoring basic skill items

Item following stem "I feel confident ..."		Mean	St.Dev.
18	moving the cursor around the screen	4.48	0.75
13	using a computer to write a letter or essay	4.41	0.72
4	exiting from a program	4.13	0.86
9	making selections from an on-screen menu	4.07	0.57
19	calling up a file to view on a screen	4.07	0.90

The item "I feel confident copying a disk" recorded the lowest mean (2.73). Only two other items had a mean less than 3.00.

As a whole this group of pre-service teacher education students believed they had the ability to perform a range of basic computing skills. More than 90% of the respondents indicated that they either agreed or strongly agreed with all five items shown in Table 1. By contrast, for the item "I feel confident copying a disk" fewer than 30% of the participants agreed or strongly agreed.

For those items categorised as relating to advanced computing skills, the item, "I feel confident about learning to use a variety of programs" (mean = 3.63) was the only one with a mean greater than 3.00. This contrasted with three items that had means of approximately 2.00 or less, as set out in Table 2.

Table 2 Means and standard deviations of low scoring advanced skill items

Item following stem "I feel confident ..."		Mean	St.Dev.
11	writing simple programs or procedures	1.70	0.89
8	troubleshooting computer problems	1.89	0.88
7	explaining why a program will or will not run on a given computer	2.04	0.92

People confident in their ability to perform these items would have learned computer programming and would have experience using computers. Neither of these is a characteristic of the participants in this study, so it is not surprising that these items would rate lowly.

School Computer Access Survey (SCAS)

This item was administered twice, in May and then November, on each occasion following the return of the student teachers to university from a teaching practice in schools. Three items asked about the amount of computer use during the practicum by teacher education students, their supervising teachers, and the computer specialist teacher,

if this person existed in the school. Table 3 shows the amount of computer use by each of these three groups.

Table 3 Teacher computer use for teaching/learning (percentages)

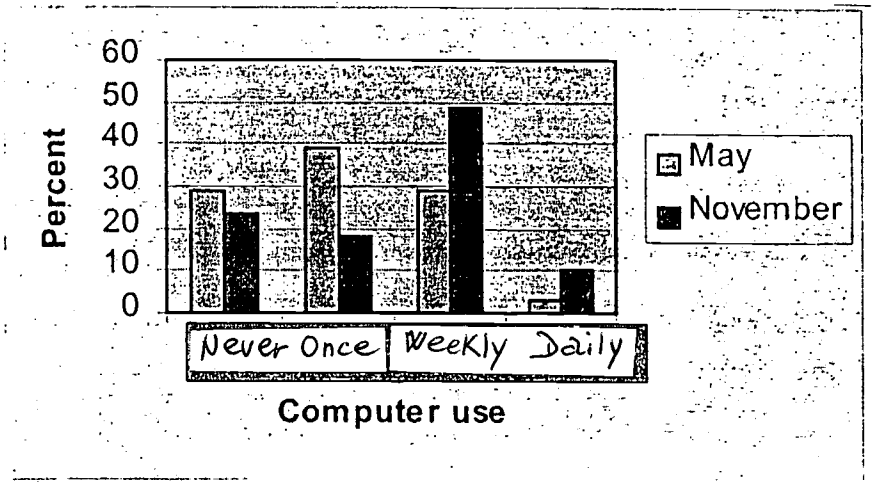
	Never used		Used once		Used weekly		Used daily	
	May	Nov.	May	Nov.	May	Nov.	May	Nov.
Supervisors	22.6	20.5	45.2	25.6	29.0	46.2	3.2	7.7
Students	29.0	23.1	38.7	17.9	29.0	48.7	3.2	10.3
Specialists**	0	0	26.7	37.7	73.3	62.3	0	0

** These figures apply to the 48.4% of schools with a specialist computing teacher.

The data shows that fewer than one-third of the supervising teachers used computers more than once or twice over the period covered by this survey. The low level of daily computer use is most surprising in light of efforts by the State Department of Education to make use of learning technologies an integral part of everyday teaching and learning. It is disappointing because the efforts of schools and parents in providing computer hardware and software is not translating into computer use being a daily occurrence for teachers and students.

However this result must be linked with data which indicates that in some schools computers were only available in laboratories, and classes in these rooms were taught by specialist teachers. Data in the row labelled "Specialist teachers" of Table 3 is calculated for those schools that had a specialist computing teacher. At the time this survey was taken this amounted to almost half the schools in the survey. In general (73.3%) specialist computer teachers taught classes on a weekly basis. The instrument used for this survey was too crude to determine how much computers were used in addition to sessions with the specialist teacher.

Figure 1 Computer use by student teachers in May and November 1999



Data collected in November showed changes to all categories, and indicated an increased level of use by both supervisors and student teachers. Despite this increase, the overall level of use was still low, with only 7.7% of supervising teachers using computers with their students on a daily basis. Figure 1 plots changes in use among student teachers from the May to the November teaching round. Over 90% of schools in the May survey were also in the November survey.

Concluding comments

At the beginning of a one year pre-service teacher education course data was collected about participants' perceptions of their ability to use computers. Data relating to computer access and use was collected twice during the year following a practice teaching in schools.

The two data collection instruments used in this study did not probe prior computer experience or current attitudes to computers. However the high level of belief in their ability to perform basic computing tasks among the participants indicates a significant amount of prior computer experience. Several previous studies have examined interrelationships between computer self-efficacy, attitudes to computer use, and prior experience. However the results appear to vary greatly between studies, perhaps indicating the significance of context on perceived computer self-efficacy. In future years it might be expected that all entrants into pre-service teacher education courses will have mastered these basic computing skills. This would mean that more time could be allocated to developing skills and techniques directly related to classroom use of computers and other forms of learning technology.

Results from the surveys also indicate a lack of use of the technology that currently exists in elementary schools. In this project the similarity of reported use by pre-service teachers and their supervisors suggests that classroom teachers who do not use computers themselves will not encourage student teachers to use computers as part of the teaching-learning process.

A comparison of the level of use of computers in the classroom by student teachers during the May and November teaching rounds shows a considerable increase, with the amount of daily use increasing by a factor of three. While this, together with an increase in weekly use, is encouraging, the number of student teachers who did not use computers at all is a cause for concern. The fact that almost one student teacher in four did not use computers in the classroom indicates that there is still a long way to go before every student in every school at every level has the option of using learning technologies when it is appropriate.

Teachers at all levels will continue to be expected to make increased use of computers and other learning technologies. For beginning and student teachers the focus has shifted

away from concerns about access to technology and the acquisition of skills towards the lack of example being shown by many experienced classroom teachers.

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